



# Analysis of maxillofacial prosthetics at university dental hospitals in the capital region of Korea

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**PURPOSE.** The purpose of this study was to investigate the demographic patterns of maxillofacial prosthetic treatment to identify the characteristics and geographic distribution of patients with maxillofacial prosthetics in the capital region of Korea. **MATERIALS AND METHODS.** This retrospective analytical multicenter study was performed by chart reviews. This study included patients who visited the department of prosthodontics at four university dental hospitals for maxillofacial prosthetic rehabilitation. Patients with facial and congenital defects or with insufficient medical data were excluded. The patients were classified into three categories based on the location of the defect. Patients' sex, age, and residential area were analyzed. Pearson's chi-square test with a significance level of 0.05 was used to analyze the variables. **RESULTS.** Among 540 patients with maxillofacial prosthetics, there were 284 (52.59%) male patients and 256 (47.41%) female patients. The number of the patients varied greatly by hospital. Most patients were older than 70, and the most common defect was a hard palate defect. Chi-square analysis did not identify any significant differences in sex, age, and distance to hospital for any defect group ( $P>.05$ ). **CONCLUSION.** The results of this study indicated that there was imbalance in the distribution of patients with maxillofacial prosthetic among the hospitals in the capital region of Korea. Considerations on specialists and insurance policies for the improvement of maxillofacial prosthetics in Korea are required. [*J Adv Prosthodont* 2016;8:229-34]

**KEY WORDS:** Maxillofacial prosthesis; Head and neck neoplasms; Palatal obturators; Mandibular prosthesis; Velopharyngeal insufficiency

## INTRODUCTION

Cancer in the maxillofacial area is a disease with a long history.<sup>1</sup> The first evidence of it was found in an Egyptian skull around 3000 B.C.<sup>2</sup> People have struggled to fight

against cancer since then, and treatments for oral and maxillofacial cancer, including maxillectomy and mandibulectomy, have increased survival rates. The primary objectives of cancer treatment are curing the disease and preventing any recurrence.<sup>3</sup> Although treatments for cancer in the head and neck area have been developed and treatments including radiation therapy and chemotherapy have been introduced, surgical resection is still the primary treatment option.<sup>3,4</sup> After ablative surgery for cancer, defects occur in head and neck structures, and maxillofacial prosthetics are required to correct these. Maxillofacial prosthetics is a branch of prosthodontics concerned with the restoration and/or replacement of stomatognathic and craniofacial structures with prostheses.<sup>5,6</sup>

The objectives of maxillofacial prosthetics are the restoration of oral and maxillofacial function, preservation of residual structures after surgical treatment, and enhance-

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ment of orofacial esthetics.<sup>6,7</sup> These are important because they help patients with their social life after treatment.<sup>6,8</sup> Maxillofacial prosthetics is the most important method of rehabilitation and is beneficial to patients. It provides non-surgical rehabilitation for patients who have anatomical or physiologic defects due to congenital deficiency, trauma, or neoplasm. Maxillofacial prosthetics is associated with the speech, mastication, deglutition functions, and esthetics<sup>7,9,10</sup> and has several advantages over surgical intervention. It can provide better esthetic results, which cannot be achieved with surgical reconstruction. It is also less invasive and helps patients avoid surgery. In addition, it provides predictable and cheaper treatment, less morbidity to patients, and a reasonable level of functional restoration.<sup>8,11</sup> Maxillofacial prosthetics is important in allowing patients to rejoin society.<sup>6,8</sup> Though these treatments can be challenging, physicians find this to be a rewarding clinical area.

Maxillofacial prosthetics for acquired defects can be classified into several categories.<sup>7,9</sup> Based on the location, oral and maxillofacial defects can be divided into intraoral and extraoral (facial) defects. Acquired intraoral defects can be classified into maxillary and mandibular defects.<sup>11</sup> As the rehabilitation of hard palate defect differs from that of velopharyngeal defects, acquired hard palate defects need to be separated from acquired soft palate defects.

According to the statistics reported by Korea Central Cancer Registry and the Korean Ministry of Health and Welfare in 2015, there were 3,176 estimated new cancers in the lip, oral cavity and pharynx, in 2,339 males and 837 females.<sup>12</sup> Because all patients who previously had resective surgery as a treatment of maxillofacial cancer do not necessarily have defects and receive prosthetic treatment, it is important to identify the number of patients with significant maxillofacial defects. The number of the patients who had specific disease and were treated in the hospital can be influenced by various factors, including preparation of the adequate facilities, existence of the specialists, or dental policies set by the government. Therefore, collection of data related to maxillofacial prosthetics in Korea might contribute to the preparation of treatment plans for patients with maxillofacial defects, establishment of treatment procedures in maxillofacial prosthetics, and improvement of maxillofacial prosthetics techniques, and may provide the basis for new policies to help these patients, including insurance.

There are regional variations in the incidence of head and neck cancer.<sup>3,13-15</sup> Patients with maxillofacial prosthetic were analyzed based on geographic region and hospital to obtain additional information on health policy related to cancer treatment. Since most maxillofacial defects are acquired defects from head and neck cancer, the incidence of maxillofacial prosthetics might be influenced by different regions in Korea. As serious functional problems related to basic survival and social life may arise with maxillofacial defects, maxillofacial prosthetics treatment is one of the most important treatments in dentistry. However, there have been no studies on the incidence of maxillofacial

prosthetics treatment in Korea.

The purpose of this study was to investigate the demographic patterns and types of maxillofacial prosthetic treatment, to find out the distribution of patients with maxillofacial prosthetics based on hospitals in the capital region, and to provide information on maxillofacial prosthetics to inform decisions on treatment priorities and insurance policies in Korea.

## MATERIALS AND METHODS

This retrospective analytical multicenter study was done through chart reviews on patients at four university dental hospitals in Korea's large cities. Patients who visited the department of prosthodontics in dental hospitals for the replacement of stomatognathic and craniofacial structures using maxillofacial prostheses were analyzed. They were classified into three categories based on the location of the defect. The data was also analyzed in terms of sex, age, and the defect location. In addition, patients' residential area and their choice of the hospitals were analyzed.

In this cross-sectional study, patients who got maxillofacial prosthetic treatment in the capital region of Korea were analyzed. The Seoul Capital area includes Seoul, Incheon, and Gyeonggi-do administrative districts and has a population of 25.05 million people, out of 50.62 million in Korea. It occupies more than 49.48% of the population, according to the results of the 2015 population and housing census by the Korea National Statistical Office. Patients from all over the nation are able to visit hospitals in the capital region for cancer-related diseases due to the development of transportation such as high-speed railway system. Considering that maxillofacial prosthetic rehabilitation is a difficult treatment in private dental offices, university dental hospitals in the capital region likely represent most maxillofacial prosthetics in Korea.<sup>7</sup> Seoul National University Dental Hospital, Yonsei University Dental Hospital, Kyung Hee University Dental Hospital, and Dankook University Dental Hospital in Chonan were selected. Although Dankook University Dental Hospital is located in Chonan of the Chungcheong province, it was included because many people consider it to be within the capital area due to the development of transportation system and because it is in the same economic bloc. Moreover, as Dankook University Dental Hospital is one of the biggest dental hospitals that patients with maxillofacial prosthetics are likely to visit, it was included in this analysis.

Records of the patients who visited the department of prosthodontics for maxillofacial prosthetic rehabilitation were obtained and reviewed. To analyze patients with acquired intraoral maxillofacial defects, data from January of 2010 to December of 2014 was collected. Facial and congenital defects were excluded from this study, as there were very few patients with these. Patients whose data were insufficient for the analysis were also excluded. Acquired intraoral maxillofacial defects were divided into three categories based on the location of the defect: hard palate

defect, mandibular defect, and soft palate defect. When the patients had both hard palate and mandibular defects at the same time, they were included in both categories. When the hard palate and mandibular defect were combined with a soft palate defect, it was assumed to originate from the hard palate or mandibular defect. Patients classified with a soft palate defect had a defect exclusively in that region.

Information on patient age, sex, address, and the type of defect was collected and analyzed. After the patients were classified into hard palate, mandible, and soft palate defect groups, they were analyzed based on the patient's age and gender. The patients were divided into 8 age groups: 0-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, and over 71. Proportions were used to describe the gender and age frequencies of the patients. Pearson's chi-square test with a significance level of 0.05 was used to analyze the relationship between the defect and gender and between the defect and age using a statistical software package (SPSS 12, SPSS Inc., Chicago, IL, USA). The patients' addresses were also collected to investigate whether they came from distant areas or from areas near the hospitals. The patients in Seoul National University Dental Hospital were subjected to analysis related to their residential area. Patients who visited Seoul National University Hospitals were classified into two categories. If patients came from capital region, that is, from Seoul or Gyeonggi province, the patients were regarded as close distance patients. Patients from other areas were classified as long distance patients. Pearson's chi-square test with a significance level of 0.05 was used for to analyze whether defects were related to the distance from the hospital.

A detailed analysis of each defect type will be presented in succeeding studies. The protocol of this study was approved by the Institutional Review Board of Seoul National University (No. S-D20150021).

## RESULTS

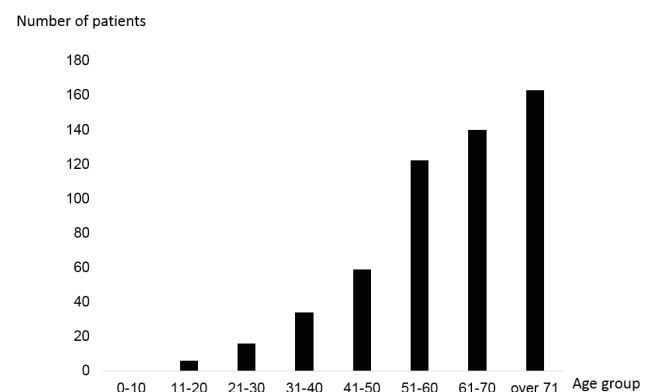
Five-hundred and forty maxillofacial prosthetics patients were analyzed, with slightly more male patients than female patients. There were 284 male patients (52.59%) and 256 female patients (47.41%). The number of maxillofacial prosthetics patients varied greatly by hospital. Seoul

National University had the greatest number of patients. Table 1 shows the total number of patients at the four dental hospitals.

Patients' ages ranged from 12 to 93. There were 163 patients over 70 years old, which was the largest age group. The next largest age group was the 61-70 group, followed by the patients aged between 51 and 60 (Fig. 1). In general, the number of patients increased with age. All defect groups showed the same trends. Table 2, Table 3, and Table 4 show age distribution based on the defect in four dental hospitals.

When the patients were classified based on the defect, most patients had a hard palate defect, followed by mandibular defect and soft palate defect. 321 patients had a maxillary defect, 17 patients had a soft palate defect, and 202 patients had a mandibular defect. The number of the male and female patients based on the defect is summarized in Table 5.

In statistical analysis using Pearson's chi-square test, there was no significant difference in the defect types based on gender ( $P > .05$ ) and age ( $P > .05$ ). However, patient age showed a normal distribution. Out of 483 patients who visited the Seoul National Dental Hospital, 322 patients came



**Fig. 1.** Age distribution of patients in all four dental hospitals.

**Table 1.** Number of male and female patients with maxillofacial prosthetics in the department of prosthodontics of university hospitals in the capital region

Dental University Hospital	Male	Female	Total
Dankook	13	8	21
Kyung Hee	7	4	11
Seoul National	246	237	483
Yonsei	17	8	25
Total	283	257	540

**Table 2.** Patient age distribution classified by hard palate defect

Age	Dankook			Kyung Hee			Seoul National			Yonsei			Total		
	M	F	Sum	M	F	Sum	M	F	Sum	M	F	Sum	M	F	Sum
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-20	0	0	0	0	0	0	2	2	4	0	0	0	2	2	4
21-30	0	0	0	0	0	0	3	3	6	1	0	1	4	3	7
31-40	0	1	1	0	0	0	12	7	19	1	0	1	13	8	21
41-50	0	2	2	0	1	1	10	14	24	3	2	5	13	19	32
51-60	3	2	5	2	0	2	31	31	62	2	3	5	38	36	74
61-70	2	0	2	2	1	3	37	39	76	4	1	5	45	41	86
Over 71	2	1	3	3	1	4	37	48	85	3	2	5	45	52	97

**Table 3.** Patient age distribution classified by mandibular defect

Age	Dankook			Kyung Hee			Seoul National			Yonsei			Total		
	M	F	Sum	M	F	Sum	M	F	Sum	M	F	Sum	M	F	Sum
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-20	0	0	0	0	0	0	2	0	2	0	0	0	2	0	2
21-30	0	0	0	0	0	0	6	3	9	0	0	0	6	3	9
31-40	1	1	2	0	1	1	6	4	10	0	0	0	7	6	13
41-50	0	0	0	0	0	0	8	16	24	1	0	1	9	16	25
51-60	1	0	1	0	0	0	27	16	43	0	0	0	28	16	44
61-70	2	0	2	0	0	0	27	21	48	0	0	0	29	21	50
Over 71	1	1	2	0	0	0	28	29	57	0	0	0	29	30	59

**Table 4.** Patient age distribution classified by acquired soft palate defect

Age	Dankook			Kyung Hee			Seoul National			Yonsei			Total		
	M	F	Sum	M	F	Sum	M	F	Sum	M	F	Sum	M	F	Sum
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41-50	0	0	0	0	0	0	2	0	2	0	0	0	2	0	2
51-60	1	0	1	0	0	0	3	0	3	0	0	0	4	0	4
61-70	0	0	0	0	0	0	2	1	3	1	0	1	3	1	4
Over 71	0	0	0	0	0	0	5	1	6	1	0	1	6	1	7

**Table 5.** Number of patients based on the defect location

	Male	Female	Total
Hard palate	162	159	321
Soft palate	11	6	202
Mandible	110	92	17

from a close distance (66.53%) and 162 patients came from a long distance (33.47%). There was no significant difference in the travel distance based on hard palate defects, soft palate defects, or mandibular defects ( $P > .05$ ).

## DISCUSSION

According to a report by Korea Central Cancer Registry and Korean Ministry of Health and Welfare, males had a larger number of estimated first-time cancers, with a male to female ratio of nearly 3:1.<sup>12</sup> This was not in accordance with the number of patients with maxillofacial prosthetics in this study, which had a similar number of male and female patients. Therefore, it can be assumed that patients with maxillofacial prosthetics do not coincide exactly with the occurrence of neoplasms. The variety of the neoplasm types, treatment methods, and treatment timing may be responsible for this.

Other than malignant neoplasms, trauma, benign tumors, and infection can cause defects that require prosthetic treatment.<sup>16,17</sup> However, in the preliminary survey for this study, most defects originated from treatment for maxillofacial cancer, and other causes of the defects were not noticeable. The origin of the defect was not considered in this study.

The results of the study show that the number of patients with maxillofacial prosthetics is closely related to age. Head and neck cancer is related to an increase in age.<sup>18,19</sup> Age is important in maxillofacial prosthetics because techniques or materials can be limited and can both influence the treatment plan in geriatric patients.<sup>20</sup> Furthermore, it is important to consider general health condition when treating geriatric patients.

Most patients had a hard palate defect, followed by mandibular defects and soft palate defects. Patients with facial defects and congenital anomalies are expected to seek prosthodontic treatments. However, it was difficult to find such patients. Considering that maxillofacial prosthetic patients are more likely to go to big dental hospitals instead of choosing local dental clinics due to the difficulty of the treatment, it was strange that patients with facial and congenital defects were difficult to find.

In this study, only the number of new patients was counted. However, when clinic time is considered, patient visits and time spent may have been overestimated since maxillofacial prosthetics patients need to be rechecked more often than general prosthodontic patients and maxillofacial prostheses can be fabricated repeatedly. Among the hospitals that participated in this survey, Seoul National University Dental Hospital had the largest number of maxillofacial prosthetics patients. There was an extremely uneven patient distribution, potentially due to the small size of the country and the transportation like a high-speed railway system. In addition, patients seemed to go to the department of prosthodontics that belonged to the hospital where they had the surgery. The number of the patients with maxillofacial prosthetics was also influenced by the

activities of the surgeons in the hospital. However, balanced development of the hospitals and the education of future maxillofacial prosthodontists are necessary to provide high quality treatment for maxillofacial patients in Korea. Specialized hospitals with experienced prosthodontists are essential for maxillofacial prosthetic treatment related to the restoration of facial esthetics, basic functions, and social life. The absence of appropriate dental hospitals for maxillofacial prosthetics can lead to several problems including discontinuity of care and lost opportunities for treatment. An imbalance of institutions that can provide maxillofacial prosthetics can affect social welfare budgets due to inefficient use of dental insurance services. Patients can also experience inconvenience, such as long waiting time, due the congestion of patients at a particular site. Although problems related to maxillofacial prosthetics are distant from the 'dental tourism' issue, patients who have trouble finding an appropriate hospital may seek foreign hospitals to obtain the appropriate maxillofacial prosthetic treatment.<sup>21</sup>

The distribution and the number of the patients and the patterns of treatment are influenced by the dental insurance system provided by the government. Coverage of maxillofacial prosthetics by insurance is necessary because the severity of the defect can impact quality of life and can be a social issue. In addition, the capacity of the dental hospitals is limited, so resources have to be distributed efficiently. Insurance coverage of maxillofacial prosthetics can help to identify the patients in need and may help with predictions to guide future public health policies.

This study was performed with only four dental hospitals in the capital region of Korea. Although almost half of the total Korean population lives in the Seoul capital region, the exclusion of dental hospitals in eastern and southern regions of Korea would be the limitation of this study. Defect patterns and important factors in treatment can change with the development of technology. Further studies, including nationwide demographic studies on maxillofacial prosthetics, long-term studies showing changes in factors related to the patients needing treatment, and studies establishing patient records forms, are needed. In addition, defining the roles of general dentists in local communities and developing a referral system for these patients are needed. Analysis of the socioeconomic status of patients with oral and maxillofacial defects would be beneficial for the patients and would help form government policy.

## CONCLUSION

More than 500 patients needing maxillofacial prosthetics were treated at four university dental hospitals in the capital region of Korea over the past 5 years. Characteristics of this special treatment, including defect patterns and their age-dependent trends, should be considered in treatment. The results of this study indicated that there was a severe imbalance in the distribution of patients with maxillofacial prosthetics among the hospitals in the capital region of



Korea. Considerations on specialists and insurance policies for the improvement of maxillofacial prosthetics in Korea are required. Although maxillofacial patients are more likely to be treated in large hospitals, the roles of local dental clinics should be defined as well.

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